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Short Communication

Heterotic pattern of some early generation inbreds derived from two maize (*Zea mays* L.) populations

A. K. Choudhary[1] and L. B. Chaudhari

Department of Plant Breeding, Rajendra Agricultural University, Pusa 848 125

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Limited attempts have been made at the population level to identify heterotic patterns among CIMMYT's maize (*Zea mays* L.) populations and pools [1]. In such endeavours, interpopulation crosses have been found superior to intrapopulation crosses. However, a few of intrapopulation crosses have been reported at par with the best interpopulation combinations [2]. There are ample evidences which do suggest that assessment of heterotic patterns of early generation inbreds (S1/S2/S3 lines) would be desirable as it minimizes the cost and labour in carrying them over to complete homozygosity [3]. The primary objective of this study was to generate information on the heterotic patterns of some S1 lines derived from two populations and eventually to form a new heterotic group.

Jogia Local and DH8644 were taken as the source populations for the present investigation. Each population was grown in isolation during kharif 1993 at normal plant density. Each plot was subdivided into five grids. Ten plants based on the desirable morphological features were selected in each grid prior to flowering. These selects were selfed. At harvest, selection pressure was applied further for economic traits and only one SI line per grid was retained. Thus a total of ten SI lines (P1, ..., P5 from Jogia Local and P6, ..., P10 from DH8644) were selected. In the following season, two sets of diallel and one set of intercrosses were made to obtain a total of forty-five crosses (10+10+25=45). During rabi 1995, these crosses along with five checks namely RHM1, CM400 x CM300, CM202 x CM111, and the two source population were evaluated in a randomized complete block design. All the entries were provided optimum agronomic package and practices. Data were recorded on four traits namely, ear length, kernels/row, 1000-grain wt., and grain yield/plot. Five randomly selected competitive plants were taken to record observations for the first three traits. Grain yield was assessed on per plot basis. The analysis of variance was performed through least square technique as elaborated by Singh and Chaudhary [4]. Economic heterosis was computed and put to test of significance for all crosses.

The analysis of variance of crosses along with checks indicated significant differences among themselves for all the four traits. The mean squares due to crosses *vs.* checks which is a test of mean standard heterosis (heterosis over the check variety) were highly significant for all the characters. The analysis of variance indicated that checks differed significantly for 1000-grain weight only. However, ea. length was the greatest with DH8644 followed by RHM1. No differences were observed for the remaining three checks (Table 1). The RHM1 excelled all other checks for the other three traits. But the poor performing checks varied across characters. Only the best check, that is, DH 8644 for ear length and RHM1 for the other three traits was used to compute standard heterosis for each of the forty-five crosses.

A perusal to the Table 2 indicates that more crosses showed significant heterosis for ear length than for any other character, although the proportion of crosses exhibiting positive, desirable heterosis were limited. Seven crosses showed significant heterosis for kernel/row and out of the seven, only one cross namely, P1 x P8 recorded negative heterosis (-12.37 %). Only eight crosses showed positive heterosis for 1000-grain wt.; most of them were with significant negative estimates. About 20 crosses showed significant positive

Table 1. Mean performance of the checks

Characters	Checks					CD5%
	DH 8644	CM 202 x CM111	Jogia Local	RHM 1	CM400 x CM300	
Ear Length (cm)	16.26	14.60	14.86	15.33	14.50	1.83
Kernel/row (no.)	30.00	32.93	33.06	34.46	32.33	3.94
1000-grain wt.	275.00	220.00	223.33	301.00	230.00	31.80
Grain Yield (kg)	4.36	3.93	4.19	4.84	4.07	0.95

[1]Present address: Department of Plant Breeding & Genetics, SKN College of Agriculture, Jobner 303 329.

heterosis for grain yield per plot. P5 x P6 was the sole cross which showed significant negative heterosis. Preponderance of negative heterotic estimates could be accrued to the complementation of positive and negative alleles in the negative direction in the S1 lines. Some other lines combined feebly with each other so that the resulting crosses appeared only marginally superior to the best check variety. However, a few parents combined well by virtue of the particular combination of the dominant and recessive alleles at the respective loci they happened to receive during segregation so that their hybrids excelled the check varieties conspicuously with respect to the traits concerned.

As each source population provided an equal number of S1 lines, it is possible to discuss heterosis from an intra *vs.* interpopulation cross perspective. It was obvious from analysis of variance that mean squares due to intra *vs.* intercrosses were highly significant for all the four traits. This indicated significant differences between these two groups of crosses. The nine best crosses with high heterosis percentages for grain yield/plot showed that highest heterosis percentages were usually displayed by intercrosses (crosses between S_1 lines derived from different source populations). It was in consonant with the established fact that heterosis is directly proportional to the relative genetic distance between the parents (within limits) and it increases with the diversity of uniting gametes. The findings are also in unison with those of Han *et al.* [2] and Mukherjee and Ahuja [5].However, an intracross, P2 x P4 excelled all other crosses for kernel/row; but it was at par with the P2 x P9, an intercross. In general, about 70-80 percent of better performing crosses belonged to interpopulation cross group; but the same was not true for 1000 grain weight. Although the frequency of interpopulation crosses was low for this trait, however, such crosses showed conspicuous superiority but for P7 x P8 to their counterparts. Similar findings have also been noted by Han *et al.* [2] and Vasal *et al.* [6 &7]. Based on high heterosis percentages, the best nine crosses were pooled to constitute a new heterotic group for grain yield/plot, which could be utilized in future breeding programme.

Table 2. Heterotic pattern (%) of crosses over the best check

Crosses	Characters			
	Ear length (over DH 8644)	Kernel/ row(over RHM1)	1000-grain wt. (over RHM1)	Grain yield/plot (over RHM1)
P1 x P2	-11.47*	-5.99	-3.43	-2.02
x P3	-10.24	-0.77	-27.90*	-11.93
x P4	-17.62*	-10.63	-26.57*	-7.63
x P5	-2.45	-0.58	-1.43	18.24*
P2 x P3	-2.86	1.54	-8.19	25.45*
x P4	10.24	18.56*	-24.91*	44.14*
x P5	-11.06*	2.32	-29.56*	-2.02
P3 x P4	0.81	6.57	-8.30	5.85
x P5	12.50*	17.60*	-11.62*	12.61
P4 x P5	-6.96	5.51	7.64	6.30
P6 x P7	-7.78	-0.38	6.09	-3.15
x P8	-12.09*	-8.12	-13.62*	-1.35
x P9	1.63	-7.73	12.51*	1.35
x P10	-12.29*	-2.51	8.30	28.15*
P7 x P8	4.91	-12.37*	22.92*	-13.51
x P9	3.68	0.96	11.62*	25.90*
x P10	-2.04	-6.86	14.28*	6.98
P8 x P9	-6.55	-2.70	-9.96	-5.40
x P10	-11.06*	-5.80	-1.21	2.47
P9 x P10	-9.42	-8.70	-4.42	12.83
P1 x P6#	-4.50	-9.67	-32.11*	-3.60
x P7	11.88*	-0.19	3.87	64.41*
x P8	10.24	-1.06	-3.87	17.56
x P9	-0.20	0.38	-0.11	28.37*
x P10	-16.80*	-0.96	-7.08	21.62*
P2 x P6	-3.89	-1.35	-4.76	43.69*
x P7	3.27	8.12	1.32	59.68*
x P8	-15.98*	-0.19	-15.28*	6.30
x P9	3.27	18.37*	-17.05*	10.13
x P10	15.77*	4.44	-6.97	21.81*
P3 x P6	0.00	-8.70	-7.30	17.79*
x P7	-7.37	9.09	-12.51	6.30
x P8	6.96	8.51	-7.53	72.97*
x P9	-1.22	13.63*	-9.30	0.00
x P10	-6.96	-3.86	2.65	-3.04
P4 x P6	6.55	10.86	-17.71*	10.36
x P7	1.22	-1.35	20.15*	37.16*
x P8	8.19	5.99	-7.86	21.84*
x P9	8.60	13.73*	3.87	40.54*
x P10	-6.96	-7.35	-6.31	-12.16
P5 x P6	1.63	16.63*	-21.92*	-19.81*
x P7	-10.04	-1.06	-14.95*	10.36
x P8	2.04	10.54	19.60*	18.24*
x P9	-1.63	-6.67	23.14*	44.14*
x P10	4.71	8.89	24.03	-9.68
CD5%	1.83cm	3.70	31.00gm	0.78 kg

*Significant at P = 0.05.
All downward crosses are interpopulation interline crosses.

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